

MULTIMEDIA



UNIVERSITY

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2017/2018

**TGD2151 – COMPUTER GRAPHICS FUNDAMENTALS**  
**TCS2111 - COMPUTER GRAPHICS**

( All sections / Groups )

21 OCTOBER 2017  
2.30 p.m. – 4.30 p.m.  
( 2 Hours )

| Question No. | Marks |
|--------------|-------|
| 1            |       |
| 2            |       |
| 3            |       |
| 4            |       |
| Total        |       |

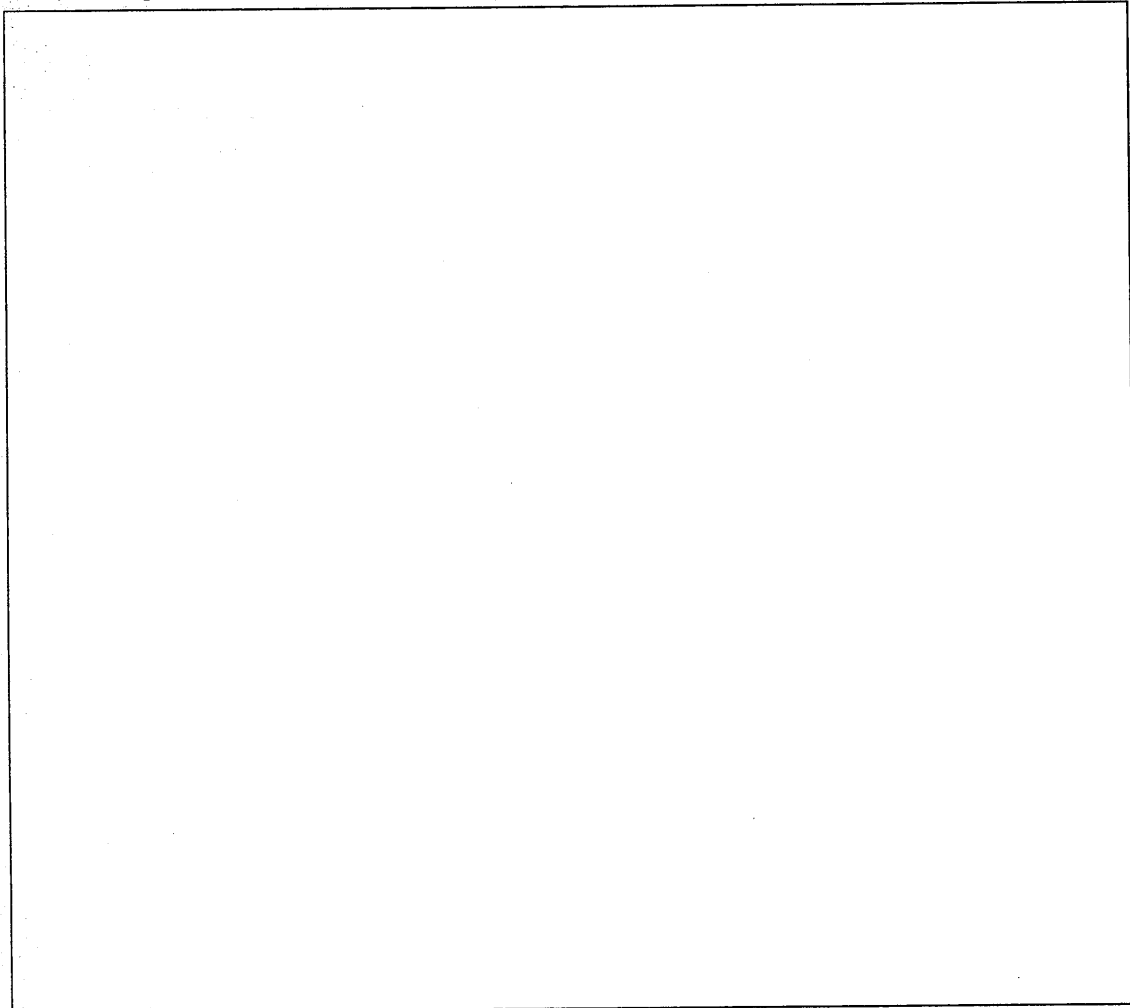
### INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 7 pages with 4 Questions only.
2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers **CLEARLY** in this Question paper.

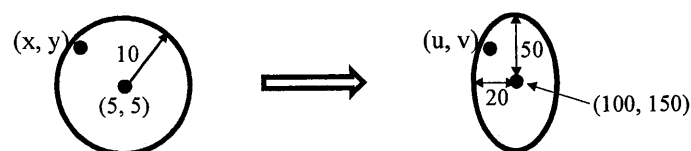
**QUESTION 1**

- a) In graphics program, one needs to deal with multiple coordinate systems and the conversion of the coordinates from one system to another. Describe the following coordinate systems: [5 marks]

- i) World Coordinate System
- ii) Object Coordinate System
- iii) Viewpoint Coordinate System
- iv) Screen Coordinate System
- v) Viewport Coordinate System



- b) Window-to-Viewport mapping is the process of mapping or transforming a two-dimensional, world-coordinate scene to device coordinates. Find the window to viewport transformation for the figure below. [3 marks]



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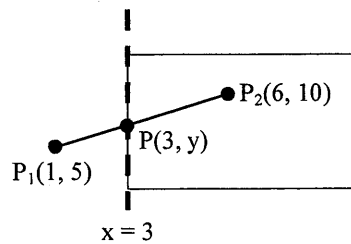
- c) What is the size of the frame buffer required (in Kilo-bytes, Kb) for a raster system with resolution 1280 x 1024 to store 12 bits per pixel? [2 marks]

## QUESTION 2

- a) Determine whether each statement of line-clipping algorithms (Cohen-Sutherland algorithm, Liang-Barsky algorithm, Cyrus-Beck algorithm, Nicholl-Lee-Nicholl algorithm and Fast Clipping algorithm) below is **True (T)** or **False (F)**. Note: **Circle your answer!** [5 marks]
- i) Cohen-Sutherland algorithm divides a 2D space into 9 regions, of which only the middle part is visible. [ T / F ]
- ii) Liang-Barsky algorithm uses the parametric equation of a line and inequalities to describe the range of the clipping box to determine the intersections between the line and the clipping box. [ T / F ]
- iii) Cyrus-Beck algorithm is a simplified version of Liang-Barsky algorithm that was optimized for a rectangular clip window. [ T / F ]

Continued...

- iv) Nicholl-Lee-Nicholl algorithm is a fast line-clipping algorithm that reduces the chances of clipping a single line segment multiple times, as may happen in the Cohen-Sutherland algorithm. [ T / F ]
- v) Fast clipping algorithm shares the similarity with Cohen-Sutherland that the start and end positions are classified by which portion of the 9-area grid they occupy. [ T / F ]
- b) Using Cohen-Sutherland line-clipping algorithm, show the conditions of Trivial Accept and Trivial Reject for the line below. Then, compute the intersection point and state the new end point. [5 marks]



Continued...

**QUESTION 3**

- a) i) What is the 2D composite matrix in homogeneous form if an object is scaled with the scaling factor (2, 3) and translated 4 units along x-axis and 3 unit along y-axis.

[3 marks]

- ii) What is the resultant coordinate of point P' if the transformation event in Q3a(i) is applied to the point P at (3, 6).

[2 marks]

- b) Although Depth-buffer method (Z-buffer method) is simple to implement for detecting visible surfaces, why it is not in favour by many researchers? Give two (2) reasons.

[2 marks]

Continued...

c) Determine whether the surfaces below is visible to the viewer.

- i) A surface with normal vector  $(0, 1, 0)$  and the viewer is looking at direction  $(2, 3, 1)$ .
- ii) A surface with normal vector  $(2, 0, -3)$  and the viewer stands at coordinate  $(2, 1, -4)$  looking at the surface.

[3 marks]

#### QUESTION 4

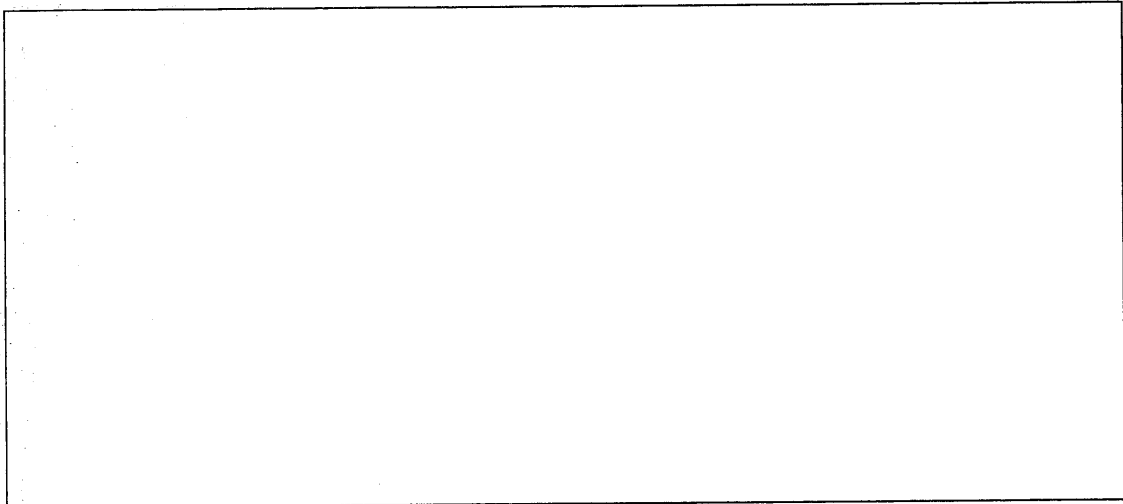
a) i) What is local illumination model? Give one (1) example.

[2 marks]

- ii) Compute the intensity of the diffuse reflection and specular reflection at a point  $P$  if the unit light vector  $L$  is  $(-1, 1, 2)$ , normal vector  $N$  is  $(0, 1, 0)$ , unit viewer vector  $V$  is  $(0, 2, 1)$ , intensity of the diffuse light and specular light are  $I_d = 1.0$  and  $I_s = 0.6$  respectively, and the coefficient of the diffuse light and specular light are  $K_d = 0.5$ ,  $K_s = 0.5$  and Specular reflection exponent,  $n = 10$ .

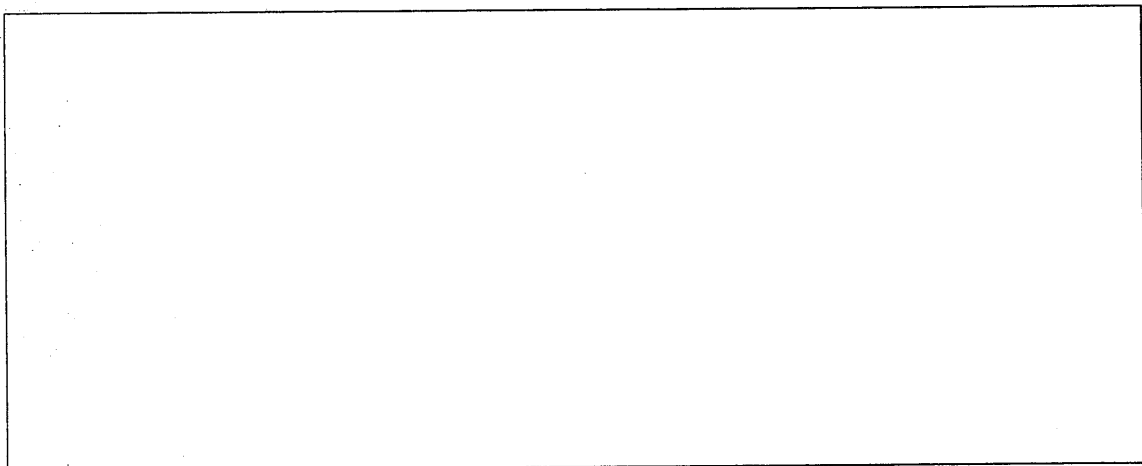
[4 marks]

Continued...



- b) A point light source  $P$  located at  $(1, 2, 0)$  with the light intensity  $I_p = 0.9$ . Compute the intensity of the light at point  $Q(1, -2, 5)$  on a surface if the light attenuation factor is

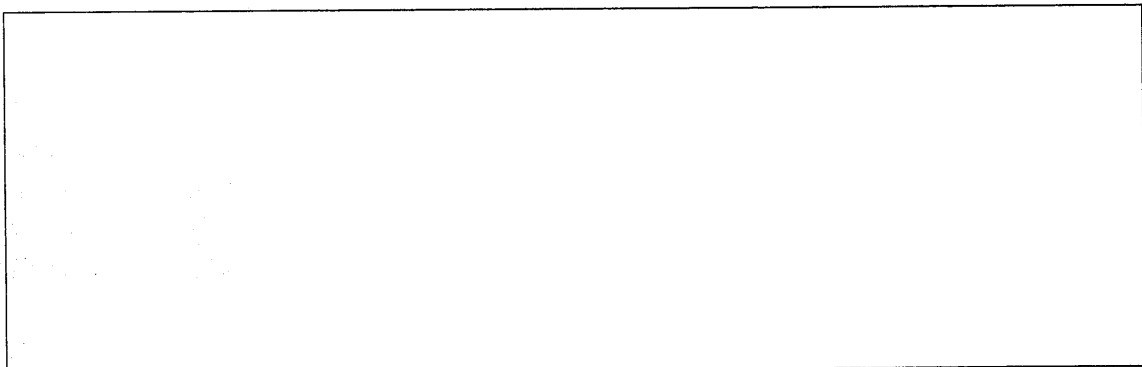
$$f = \frac{1}{a_0 + a_1 d}, \text{ where } d \text{ is the distance, } a_0 = 0.5 \text{ and } a_1 = 1.0. \quad [3 \text{ marks}]$$



- c) Discuss the following shading methods:

[1 mark]

- i.) Gouraud shading
- ii.) Phong shading



End of Page!